

Learning

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Key Summary Points

1. To use COTS games in the classroom effectively, teachers need to be familiar with both the subject matter, and the game.
2. Reference and support materials surrounding a COTS game are essential to the game's in-class utility.
3. The ability of the game to fit in with the topics being taught is more important than the game's popularity.

Key Terms

Instructional Design

Pedagogy

COTS (Commercial Off-the-Shelf)

Edutainment Era

"Big G" games

Short Form Games

ESL (English as a Second Language)

HE (Higher Education)

K-12 (Kindergarten to Grade 12)

Introduction

Digital games are being used more and more often as teaching resources in the classroom (Habgood & Ainsworth, 2011). Some are games designed specifically for educational purposes, and others—commonly known as COTS (commercial off-the-shelf) games—are commercial games that were designed for entertainment, but have educational value as well. Some of these, like *The Sims*, *Civilization*, and *Portal*, have come to be seen as educational games despite having commercial success outside of education. COTS games may be free to download or play, or games that must be purchased. They can be for any platform, including mobile.

While there appears to be a gradually growing acceptance of the use of games for learning, this acceptance is largely focused on games designed specifically for learning, in other words, serious games where the educational purpose of the game is explicit and was likely part of the design goals right from the start. When it comes to using COTS games in the classroom, acceptance is still often replaced with skepticism (Van Eck, 2006). Some have proposed their own theories about which attributes of COTS games make them suitable candidates for use in a formal learning context, and while the body of research on the use of games for learning continues to grow, there is still no definitive evidence that any specific theory carries more weight than any other. What is clear is that the use of games for learning holds sufficient promise to warrant continued inquiry (Perrotta, Featherstone, Aston, & Houghton, 2013).

To avoid the negative backlash against games that occurred in the "Edutainment Era" we need to adopt a more moderate approach supported by evidence that our efforts are at least as good as traditional approaches, and preferably better (Wilson, 2009). The so-called Edutainment Era, which started in the mid- to late 1980s and lasted to the mid-1990s, was the first time that computer games for education became popular, and they were promoted by some as a panacea. All one needed to do was wrap a game around a lesson, and it would magically become fun. This, of course, is not true, and the fall from grace for many educational games developers left them reeling.

By once again preaching that games are effective and useful for learning we give the impression that all games are good for everyone to learn everything (Van Eck, 2006). Clearly, this is an overstatement of fact and it is understandable how this message might turn people off to the idea of using some games to teach certain things. It is important to emphasize that whether a game is intended for use in formal education (e.g., preschool, K-12, higher education), corporate training, or other professional development, the context and activities surrounding the game are key to reaping whatever potential benefits a particular game may offer. The size of the game, that is, the amount of time it takes to learn how to play the game as well as the expected length of play are also important factors when considering games for learning.

Ultimately, the fitness of any particular game, like any other instructional technology, will depend not only on the game itself, but also on the requirements, features, and limitations of the environment in which it will be used and the people who will be using it. This chapter provides a snapshot of where we are now in our understanding of the issues and ways to address them.

Key Frameworks

The early stages of a new field are always exciting, and game-based learning generally as well as learning with COTS game specifically are still relatively new fields. Theory building and the development of new frameworks is a part of any field, but a new field typically offers especially fertile ground. There are a growing number of digital game-based learning theories and frameworks, such as James Gee's "36 Principles" (Gee, 2003) and the use of playability development techniques (Sánchez, Irazo, & Vela, 2013) and the list grows almost monthly. We could already fill an entire volume with the theories and frameworks that have been proposed to date, but instead we have chosen to highlight a few that have a particular focus on or application to COTS games, as there are some differences between COTS game and those specifically designed as games for learning. Table 1 outlines some of the main differences between COTS games and serious games with respect to how the games are designed.

Table 1. Commercial vs. Serious Games

Differences	Commercial Game Design	Serious Game Design
Concept Catalyst	Amusement and fun	Performance or knowledge gap
Key Question	Is it fun?	Does it meet learning objectives?
Focus	Player experience (how)	Message (what)
Content / Method	Method is primary (content may be irrelevant)	Method secondary to content (game often seen as receptacle)
Vantage Point	Entertainment and software engineering	Special Interest Group (SIG) (e.g., medicine, military, social change,)
Fidelity	Self-consistent, otherwise irrelevant	Faithfulness to message is essential
Credentials	Industry	SIG (and industry)

Because of these differences, COTS games will rarely contain any explicit ties to required curricula, nor will the scoring mechanisms be usable without interpretation or translation, and this is an important issue for games to be used in formal education. To complicate things further, depending on the game, a losing score can sometimes be just as valuable for meeting educational objectives as a winning one, and the actions required to achieve a positive score in a COTS game may have little to do with what players are supposed to be learning. When a COTS game is used for learning, the connections to the educational objectives will almost always be externally imposed, even when there is authentic and relevant learning taking place within the game. With serious games designed specifically for learning, these connections are usually much more obvious and in-game scores may even be directly usable by teachers for student assessment. This places COTS games in a separate category with distinct requirements.

“Big G” vs Small G Games (Gee)

Many of the most successful commercial games are what Gee (2012) refers to as “Big G” Games (Gee, 2012). He explains that “Big G” games include not only the actual software of the game, but also the social interaction around that game. Big “G” games also include a very long list of attributes such as collective, intelligence, crowd sourcing, innovation, social and embodied intelligence, cultural models, modding abilities, critical/design/systems thinking, and others, many of which relate to his original list of 36 principles from his seminal work, “What video games have to teach us about learning and literacy” (Gee, 2003). “Small g” games, on the other hand include just the game itself, or the software you use to play the game, and presumably lack the other attributes of “Big G” games, though it is not clear how many of the required attributes a game must have before it can be considered “Big”. What is clear is that according to Gee, the game by itself is not enough to create the best learning environment, but must include the social interactions around the game.

Gee describes “Big G” games as being good for learning, but there are still very few examples of commercial Big G games being used effectively in a formal educational setting. Perhaps the best-known example is that of *Civilization III* as used by Kurt Squire in a Boston area high school, where he determined that games need to be understood as a socially-mediated phenomenon (Squire, Gee, & Jenkins, 2011). Squire's results are discussed in more detail in case study one.

Simon Egenfeldt-Nielsen (2005) also conducted a classroom study as part of his doctoral work. He used the game *Europa Universalis II* in a Danish school to teach history over an eight-week period and found that external elements such as reflection and instruction are necessary to facilitate learning with COTS (Egenfeldt-Nielsen, 2005). Like Squire's study, Egenfeldt-Nielsen's study emphasized that games could foster information-handling and problem-solving skills, but there is also a need for instructor mediation when COTS games are used in a formal learning context.

Using a COTS game in a formal learning context is, in most cases, analogous to an “off-label” use. We use them knowing that this is not what they were designed for and so we must accept that the efficacy of these games will inevitably come from a well-matched pairing of learning design outside of the game and directed or goal-oriented play within the game. The aim of this chapter is to provide a framework for educators to guide them on how to achieve this pairing between COTS and the classroom.

Games as Ideal Learning Environments

Gee (2009) explains that games present an ideal learning environment for players, guiding novice players with no knowledge of the game through increasingly difficult levels until they have mastered the game. Good game designers follow learning principles, whether they realize it or not. In fact, he says that game design practice is applied learning theory (Gee, 2009). It is beyond the scope of this paper to explore every learning theory that is relevant to game based learning, but Table 2 summarizes a few key theories to show the connection between learning theory and game design practice.

Table 2. Learning Theory and Game Design Connections

Learning Principle or Technique	Game Design Practice	Educational Advantage
Activity Theory: This is based on a learner's interactions with objects, rules, and community to achieve certain goals.	Players interact with obstacles and characters (PCs and NPCs) according to game rules to achieve goals.	Learners actively engage with the content; Information is presented in context; Learners can experiment without consequence; These factors increase learning transfer.
Discovery Learning: Learners grapple with questions or challenges by drawing on experience and prior knowledge and experimenting with various solutions.	Players have to overcome game challenges by drawing on previous experiences in the game and knowledge about the game world.	Learners practice problem solving through an iterative cycle of attempting a task, receiving feedback, reflection on the outcome, and reassessment of the strategy.
Scaffolding: Teachers provide support for a task or skill that is just beyond a learner's capabilities to help the learner master the task or skill.	Games provide help in the form of slower pace, power ups, extra lives, in-game tutorials, etc. the first time a player is presented with a new challenge.	With reduced cognitive load learners can process problems more deeply.

Gee describes the properties that games have that make them “good,” such as incorporating good gamification, smart tools (inside the game), good media convergence (i.e. merging of media technologies), and taking advantage of collective and distributed intelligence. Good games have assessment built into the game, progress in the game is proven through mastery; and gameplay is contextualized and includes meaningful problem solving. However, just because a game possesses all of these properties does not mean that the things that make the game good are actually focused on elements of value in the intended educational context. For example, achieving a high Happy Home Academy (HHA) score in *Animal Crossing New Leaf* is a complex undertaking and can require all of the properties just outlined, but what players learn to earn that high HHA score is not especially useful in a real life context.

Games as Ideal Learning Environments

Gopin (2013) therefore proposes a framework for evaluating the educational potential of COTS games that takes problems like this into account. The framework evaluates games from three different perspectives:

1. Define the learning goals of the game.
2. Analyze the motivational strategies
3. Analyze the learning strategies

Gopin's framework offers a series of questions that can be used to analyze the game from these three perspectives. For example:

1. **Define the learning goals of the game:** What new skills and/or knowledge should players have when they complete the game?
2. **Analyze the motivational strategies:** Is the core mechanic satisfying? Does the game provide interesting, meaningful choices to the player? Does the game provide clear goals? Are players rewarded when they do something right? Is there feedback when players make a mistake? Does the game fantasy reinforce the learning goals?
3. **Analyze the learning strategies:** Does the game reflect how newfound skills and knowledge can be used in real life? Does the game require players to master lower level skills before progressing to harder challenges? Does the game promote critical thinking/problem solving? Is the core mechanic inherently connected to the learning content, or can the player succeed at the game without learning anything new? Does the game provide help “on demand” and “just in time?”

These questions give an educator a better understanding of how a specific game can be integrated into a learning experience. The guiding principle underlying this framework is whether or not a specific game can

support a specific learning experience; no one game is either “good” or “bad” for learning, it really depends on what a teacher wants to teach with the game.

Gee’s description of what makes a game “good,” as well as Gopin’s framework, could potentially be applied to any game that might be useful in a learning context, whether it requires many hours of play or can be completed quickly, and whether it has been designed specifically for learning (i.e. a COTS game), provided we can connect the principles with the learning goals. However, the real potential for COTS games, at least in the near future is short-form games and casual games (games with levels that are playable in 10 minutes or less) because they fit better within the natural time constraints for formal education, where activities that span more than a single class or period can be difficult. The challenges of typical classrooms (see below) are not normally conducive to the use of games that require longer playing times or have a long learning curve (Van Eck, 2012).

Challenges of a typical classroom

1. **Game format (gameplay length):** Many games do not lend themselves for use in a period-oriented format and simply need more time than is traditionally available to be effective. Some COTS games can be broken up into shorter playing sessions, but many cannot.
2. **Technology requirements:** Many COTS games assume up to date equipment; schools often don’t have that.
3. **Buy In:** Administrators have been identified as a potential barrier to the use of games in the classroom generally (Becker & Jacobsen, 2005). Many administrators have yet to be convinced that there is sound pedagogy behind the use of games in the classroom.

Adapting The NTeQ Model (Van Eck)

In Van Eck’s *Guide to Integrating COTS Games into the Classroom* (2008), he uses the NTeQ model (Lowther & Morrison, 1998) for technology integration as a starting point for the development of a template for using COTS games in the classroom, that addresses at least some of the concerns outlined above. NTeQ stands for iNtegrating Technology for inquiry, and the model includes the following elements:

1. **Specify Objectives:** What learning objectives will your students achieve from completing this lesson?
2. **Computer Functions:** Match objectives to computer functions/activities.
3. **Specifying a Problem:** What problem will your students be solving?
4. **Data Manipulation:** How will data be used? Briefly describe each manipulation activity.
5. **Results Presentation:** How will students present their results?
6. **Activities During Computer Use:** What will they do while at the computer?
7. **Activities Before Computer Use:** Prepare for computer use (e.g., brainstorming).
8. **Activities After the Computer Use:** Reflection on learning
9. **Supporting Activities,** including review of prior learning, required research and reading, and enrichment activities.
10. **Assessment:** Rubric to describe performance standards.

Van Eck adapted the basic elements of NTeQ to the use of COTS games in the classroom and some key considerations emerged, such as the challenge of finding and evaluating COTS games, which can be very time-consuming. Additionally, once we have a game and are familiar with it, we must design the lesson as well as its evaluation. In most cases, the majority of the time spent with a lesson that uses a COTS game is actually spent around the game rather than in it (Van Eck, 2008).

In other words, in an educational context, more time is typically spent in activities leading up to and following the game than actually playing it. When the game being used is a COTS game, we have already seen that the design of the lesson around the game is crucial and therefore the ability of the game to fit into the larger lesson context is an essential part of the selection process.

Essentials of Curriculum Integration

One of the biggest deficiencies when it comes to the use of COTS games in formal education as compared to games specifically designed for learning is that most COTS games lack at least one of what the author calls the Essentials of Curriculum Integration. Table 3 below outlines these essentials.

Table 3. Essentials of Curriculum Integration

Aspect	Definition	Example
Main Objective	The game is connected or connect-ABLE to formal educational objectives	The lesson will use Angry Birds as a digital manipulative to illustrate the concept of potential energy
Curricular Ties	There is a direct relationship between what the game does and what the curriculum (or syllabus) says needs to be done	Students will develop a deeper understanding of the connection between potential and kinetic energy by comparing trajectories when they pull back on a bird half

Assessment Connections	There is a clear way to map assessment in the game onto formal educational assessment	way vs all the way After playing the game and then reflecting out loud as a class, students will successfully pass a paper-and-pencil test on the topic of energy
Teacher Support	There are available resources to help teachers locate relevant games and design effective instruction around a selected game	This could include teacher's guides, study guides, lesson plans, and suggested activities, among other things.

Since games are still novel educational technologies in most formal educational contexts, teachers who wish to use them will be required to justify their use in ways not typically necessary if they decide to use a more traditional technology. As a result access to resources such as curricular ties, ways in which assessment can be used to inform student progress, and lesson plans can make the difference between a game being approved for use and not. To further complicate matters, most teachers simply do not have the time to create these resources for themselves, so if these resources do not exist, it will not matter how good the game is.

4PEG: The Four Pillars of Educational Games (Becker)

The 4PEG review template was created to address the need for a structured and consistent mechanism that could be used to analyze games intended for use in educational contexts. It consists of four parts that are each assigned individual scores, which are then combined to create an overall numerical rating. This rating can then be used as one element of a larger selection process, which should include information on instructional strategies employed by the game and the results of efficacy testing when available. The four scored parts are outlined below:

1. **Game Overview:** (30%) How satisfying is it as a game?
 - a. **Gameplay:** What can you do in the game? Are the controls logical and easy to use? Does each "level" fit the overall style of the game?
 - b. **Art & Audio:** How does it measure up aesthetically? This includes visual and auditory components.
2. **Teacher Support:** (20%)
 - a. **Guides:** How to use it.
 - b. **Plug'N'Play:** How much work is involved in fitting this game into a lesson? This also includes operation: Is installation & basic functionality explained?
 - c. **Resources:** Supplementary materials a teacher can use to better understand how to play the game, or create a lesson around the game.
 - d. **Community:** A community exists where teachers can go for help, support, to share. It is clearly identified and easy to find.
3. **Educational Content** (30%)
 - a. **Instructional Strategies:** Are the instructional strategies appropriate for the learning outcome(s)?
 - b. **Instructional Design:** Is the design in keeping with Merrill's 1st Principles of Instruction?
 - c. **Objectives:** Does it appear to fulfill the stated objectives?
 - d. **Inclusion of Learning Objectives:** Are they obvious (either in the game or in the support materials)?
 - e. **Integration:** Are the objectives integrated into the game? In other words, is it necessary to master at least some of the stated learning objectives in order to get through the game?
 - f. **Accuracy:** Is it correct?
 - g. **Assessment:** Is the scoring/assessment in the game connected to the learning objectives (or is it easy to connect them)?
4. **"Magic Bullet" Rating** (Becker, 2011) (20%) (This rating is a bit more subjective and is based on a teacher's "gut feeling" about whether a game is appropriate or not.)
 - a. **Overall Balance:** Is the relationship between the what the player can learn and must learn, both inside and outside of the game appropriate for this game given its intended use?
 - b. **Can vs. Must:** Is it possible to get through the game without learning anything (i.e. without meeting any of the educational objectives)?
 - c. **Operational vs Educational:** Is the required operational learning appropriate for the game's intended purpose?
 - d. **Educational vs Discretionary:** Is there an appropriate balance of learning and fun?

The 4PEG review is intended to form part of a resource that would also include specifics on curricular ties (such as appropriate grade levels, formal goals & objectives with which the game connects) and also lesson plans. Providing a truly objective review of a game is exceptionally difficult, but using simple number values attached to specific aspects or components being reviewed provides for the possibility of comparing different games against each other as well as contrasting different reviews of the same game.

Key Findings

In spite of the growing body of literature on the use of games in education, there are still relatively few resources that help people select COTS games for use in the classroom. A survey by Kafai, Franke, & Battey (2002) conducted at the turn of the century found that reviews of educational software tended to focus on the ease of use of the software rather than its efficacy, and while the situation has improved in the ensuing decade, it remains difficult to locate for games the kinds of teaching resources that are relatively common for other educational media.

Many existing educational reviews of COTS games mention potential subject areas or topics for which the game might be useful, but most still do not provide much in the way of specifics, so teachers are still largely left to figure out lesson plans for themselves. Also, educational reviews tend NOT to be critical enough. There are plenty of reasons for this, including:

1. Teachers are not necessarily gamers and they may not know what makes a good game.
2. The current culture of education does not foster critical reviews; instead it just celebrates and gives accolades. As a result, even ineffective games often get positive reviews.
3. Reviews rarely mention what is else could be possible (perhaps because the reviewers are not trained in technology and so they do not actually know what is possible).

Teachers must be prepared to help their students by connecting the dots between what they are learning in the game and how that relates to the topics at hand. Egenfeldt-Nielsen's study (2005) emphasized that games could foster information-handling and problem-solving skills, but there is also a need for instructor mediation when COTS games are used in a formal learning context. Teacher familiarity with the game is important, but not as important as familiarity with the curriculum being taught and general teaching competence. The best way of integrating gaming into teaching is by using it within a clear pedagogic process. (Sandford, Ulicsak, Facer, & Rudd, 2006)

While it is important for students to receive appropriate guidance to get the most out of learning sessions with COTS games, designers must also ensure that teachers are not left on their own when trying to enable game-based learning. Beyond the video game itself, teachers should have the time and the resources for offline activities to support learning. These include time to organize collaborative tasks, and the ability and the skills to provide timely guidance while students play the game.

Finally, Squire (2003) made the following suggestions as a result of his experiences with *Civilization* in the classroom:

1. Teachers must know the game. Ideally, they will have spent time actually playing it.
2. Gameplay drives learning. Teaching and learning activities should be in direct response to the game challenges.
3. Use just-in-time lectures that relate to issues the players are currently having in the game.
4. Make use of gaming communities to support learning.
5. Facilitate inquiry in and around the gameplay by compiling and comparing data.

Assessment Considerations

This chapter focuses on selection criteria for using COTS games for learning, and so the assessment considerations really center on assessing the assessments. Are we taking the appropriate criteria into account? Are there gaps in the templates or models we are using? Do favorable scores in the assessment template lead to the selection of the right games for the right courses and lessons? These kinds of questions require a collection of reviews/assessments that can be compared. The resultant games should then be tested in educational settings. While there is a growing body of research on the use of games in the classroom including both COTS and serious games, the research on selection methodologies is still in its infancy. However, there are several groups working on the creation of reviews that will be comparable, including Becker's 4PEG template, and one being developed by the International Game Developers Association (IGDA) Special Interest Group (SIG) on Learning and Education Games (IGDA-LEG), which focuses on ???.

Future Needs

There are still relatively few resources for those wishing to use COTS in the classroom, and no consistency among the few resources that make any effort at all to provide guidance on choosing and using COTS games. Teachers need to know not only which games are out there, but also how they can be used in the classroom and how they tie in to the curriculum. They also need ready-made, accessible support materials like lesson plans and activities. Some companies, like Valve (creators of *Portal* and *Portal 2*), do offer online resources geared specifically to teachers to encourage them to use the game in the classroom. However, much more needs to be done in this direction.

In addition to resources helping with game selection, teachers also need access to "canned" lesson plans that help them use the COTS game. To see what kinds of support might be easily accessible to teachers, we performed a Google search (on April 29, 2014) using the search phrase "educational game" + flight. There were over 250,000 links, but they consisted of links to a fundraising campaign, articles, research papers, a few flight simulators, and various bits of things to do with flight OR games. However, there was nothing available that

would have been of any use if I had wanted to use a game for tomorrow's class. By contrast, we also performed a search using the phrase "web quest flight." This search resulted in only 71,000 hits, but the very first page of hits included several ready-to-use web quests about flight. These resources included grade level suggestions, activities, and evaluation ideas, which are the basics needed to be able to use that lesson in a classroom tomorrow. It took a total of three minutes to find them, have a quick look at them, and pick one that could be used. These are the kinds of resources that make the incorporation of new approaches in the classroom possible, and they are still missing for most types of games.

While there are quite a lot of COTS games out there that have educational potential—both big and small—almost none of them are useful immediately in the classroom. Almost all of them require the teacher to either play the game or watch someone playing the game, analyze it, and then build a lesson from scratch, including assessments that the school will approve of and explicit ties to the required curriculum so that the use of that game can be justified to administration.

This poses a problem for teachers who are not comfortable brainstorming ways to connect games to curriculum. Sandford, et al. (2006) conducted a year-long study using three COTS games: *The Sims 2*, *RollerCoaster Tycoon 3*, and *Knights of Honor* and found that teacher familiarity with the game was important, but not as important as familiarity with the curriculum being taught and general teaching competence (Sandford, Ulicsak, Facer, & Rudd, 2006). One possible inference that can be drawn from this study, which supports findings from other studies regarding the need for active teacher involvement in the process, is that while commercial games can enhance classroom experiences with learning, they cannot compensate for the general lack of knowledge or skill on the part of the teacher in dealing with games—at least, not yet. Available resources for integrating games and curriculum would go a long way to solving this problem.

Case Study One: Language Learning

What follows are actually two brief case studies, both of which focus on language learning, and both take advantage of the language settings available in many commercial games. All games present various elements, such as settings, labels, and sometimes even dialog in multiple languages. Players may choose which language to use when they first start a game, and if they choose the language they are trying to learn, the game can help.

***The Sims* (Electronic Arts, 2000)**

Teaching a second language is a unique field, in that the way language teachers learn the language they are teaching bears little or no resemblance to the way they will be teaching it. Often, they learned the language as children growing up, either as their first language, or as one of multiple languages in common use. This is rarely true of the sciences, or history, for example. Further, teaching a language to an adult is quite a different proposition from teaching language to a child and so it requires quite a different approach.

Purushotma (2006) used *The Sims* in language learning and found that it contains many of the elements useful when teaching a language. For example, it includes a cast of characters who represent many characters from real life. Players have families, hold down jobs, build and furnish houses, and they must manage everything from what to wear to work, to how to keep their loved ones healthy and entertained. The language used in *The Sims* can be changed in the settings and many in-game objects can be looked up in the game, so the player can read about them in the target language. Objects also allow annotations, which is where translations and further explanations can be placed (Purushotma, 2006). Since the game focuses on everyday activities, it is a good match with a typical approach to language learning both in K-12 and in post-secondary courses, and could even be used as a supplement to traditional language learning textbooks (Purushotma, Thorne, & Wheatley, 2009).

***FIFA World Cup Soccer* (Electronic Arts Inc., 2004)**

This game was to be used in an Adult Education English as a Second Language (ESL) class. Soccer is a sport that the adult students taught would be familiar with according to the lesson designer and therefore the in-game commentary has a ready-made context. Even though the game is presenting commentary in the target language, the players know what is normally said and can form connections between the situation they see and the words they hear. Additionally, as is typical for many games, certain moves within the game trigger certain predictable reactions and comments from the non-playable characters (NPCs) within the game. When the game is played in English, these comments (phrases) can be elicited at will. This repeatability can be a big advantage to someone struggling to learn a new language (Wang, 2006).

Case Study Two: *Portal 2*

Portal 2 (Valve Corporation, 2011) is a sequel to the original *Portal* (Valve Corporation, 2007) both of which are enormously popular first-person puzzle-platform games where the player moves around the environment by shooting starting and ending portals into otherwise disconnected surfaces, thereby creating a link through which the player may move objects, including themselves. The game requires extensive spatial acuity and was quickly recognized for its potential use for learning physics, problem solving, and critical thinking.

Valve Corporation developed a customizable version of *Portal 2*, a popular COTs game, which allows users to develop their own rooms and portals. They also created a website to support teachers wishing to use the game and to encourage them to develop and share content (<http://www.teachwithportals.com/>). The site includes a wiki

and forum for discussion and sharing of resources as well as a separate space where teachers can submit lesson plans. All of the content is publicly available, allowing teachers to access the resources at their convenience.

Case Study Three: *Minecraft* with Second Graders (Written by Charlotte Weitzel)

Minecraft (<https://minecraft.net>) is a sandbox game. In the game, the player is allowed to build with different kinds of textured cubes, creating her own world, buildings, etc. in three dimensions. It is a game with possibilities to explore, to gather resources and to craft in, to combat in, and it is what feels like an infinite game world. *Minecraft* has become a very popular game with 100 million registered users (according to Wikipedia, as of February 25, 2014), and it is simple to play both as a multiplayer game in the game like survival mode or the creative mode, as well as on your own in creative mode, giving the possibility to build your own worlds.

The following is a description of a session with four students, all of them familiar with playing in *Minecraft* in advance. In this three-hour session, there was only one computer that could be used.

The session began with the group searching on the Internet for "The Seven Wonders of the World.". students found pictures and stories and decided that they wanted to work a Taj Mahal theme.

The students found a picture of Taj Mahal that they wanted to use as a model. While one of the students started building the Taj Mahal, originally built as a mausoleum, inside *Minecraft*, the other students sat beside and contributed with ideas on how to shape the building. I, the teacher, read aloud the story about the Shah Jahan, his wife Arjumand Bano Begum, their many children, and why the mausoleum was build and under what circumstances.

After hearing the story, the students worked in the following shifting roles: 1) building the Taj Mahal in *Minecraft*, 2) instructing fellow students in the story of Taj Mahal; and 3) acting out the story of the Taj Mahal, as retold by the students. The students performed each role for about 10 minutes and then shifted to the next role, which gave the students an opportunity to personalize and internalize the Taj Mahal story.

After building a version of the Taj Mahal inside *Minecraft*, and having settled on a version of the story, the students now started discussing how they could continue to play inside *Minecraft*. They had built a small village around Taj Mahal and started creating and placing relevant story characters inside the village, including the emperor and his wife and all their children. Next, the students acted out the Taj Mahal story inside *Minecraft* with the characters. We screen casted it, making a small film, and one of the students narrated the story for the film.

The students were very motivated throughout, reported they were having fun, and experienced a personal relationship with to story of the Taj Mahal. It was a very creative and playful process for the students, and turned out to be a very collaborative learning environment.

Best Practices

Assessment strategies for the selection of COTS games are still very much in the early stages, so it is not yet possible to declare a list of best practices. However, based on experience with selection of materials for use in learning contexts, there are a number of rules of thumb that could be applied here as well.

1. **Get specific:** Game reviews should include details about which subjects and grade-levels are appropriate venues for a specific game. In those cases where a game does not fit naturally it is even more important to provide such details. Many people could imagine using a game like *Angry Birds* to teach certain aspects of physical forces, or *Scribblenauts* for spelling or vocabulary, but using a game like *Animal Crossing New Leaf* for data gathering, graphing, and charting would need more explanation.
2. **Include numerical ratings:** While game reviews cannot really be quantitative or truly objective, associating something like a straightforward Likert scale allows for a mechanism to compare assessments. Given a sufficient number of assessments, the trend can start to become predictive.
3. **Include measures of the game as a game:** We must not neglect the nature of the object we are assessing. The game's value as a game is key. If it is not a good game to begin with, then why is it being used in the classroom?
4. **Educational aspects must be heavily weighted:** Very few teachers have a great deal of spare time. This is true for the time they have available for preparation, but it also includes the time they have available in the classroom. Using a game that takes a considerable amount of time but does not provide much in the way of educational value is not a good use of time.

Resources

Websites

Scratch website (<http://scratch.mit.edu/>)

SNAP website (<http://snap.berkeley.edu/>)

Common Sense Media website <http://www.commonsensemedia.org/>

Games and Impact.org website <http://gamesandimpact.org/games/>
 Learning Works for Kids website <http://learningworksforkids.com/playbooks/> .
 Playforce.org website <http://beta.playforce.org/> (Institute of Play <http://www.instituteofplay.org/>)
 Playful Learning website <http://playfullearning.com/>
 Teach with Portals website <http://www.teachwithportals.com/>

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Books, Reports & Papers

Egenfeldt-Nielsen, S., Heide Smith, J., & Tosca, S. P. (2013). *Understanding video games : the essential introduction* (2nd ed.). New York: Routledge.
 Gee, J. P. (2003). *What video games have to teach us about learning and literacy* (1st ed.). New York: Palgrave Macmillan.
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Games

Angry Birds
Civilization Series
GIRP (<http://www.foddy.net/GIRP.html>)
Kerbal Space Program (<https://kerbalspaceprogram.com/>)
Line Rider
Little Big Planet
MineCraft
Portal (<http://www.learnwithportals.com/>)
QWOP (and its sequel CLOP) (<http://www.foddy.net/CLOP.html>)
Scribblenauts
SimCity
SodaPlay (<http://sodaplay.com/>)
Tycoon Games (e.g., Roller Coaster, Zoo, Railroad)
The Sims 2
RollerCoaster Tycoon 3
Knights of Honor

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